EPA's Radiation Risk & Dose under CERCLA

Radiation Basics

- Radium-226 is the primary radionuclide of concern for phosphate areas in FL. It gives off gamma rays that can be easily measure remotely. The gamma radiation (flux) is measured in microrem/hour [uR/hr], and the Ra-226 concentration in soil is measured in picoCuries/gram [pCi/g]. The uR/hr value is used to describe dose to a human being, as in the amount of exposure over a period of time.

Background Levels

Soils

- Natural background levels and associated risk for Ra-226 in the U.S. range from 0.2 to 4 pCi/g. In FL, the bkgd is approx.0.9-1.0 pCi/g. These bkgd levels are approx 8E-5 potential cancer risk naturally for residents.{Note: background levels over undisturbed land as measured by EPA, FL Rad, & FIPR}

- Typical Ra-226 levels in phosphate range from background [1 pCi/g] to over 50 pCi/g. (There are no immediate or acute health risks for these levels. The health hazards are all based on long-term chronic exposure leading to a potential increase in cancer risk)

- **Flux**

- For radiation [gamma] dose rate measurements from radium and other natural radionuclides: background levels in FL and the areas undisturbed from mining are approx. 6 uR/hr {from FL Rad & FIPR}. Any measurement of ~ twice bkgd [~12 uR/hr] would be considered gamma radiation from technically enhanced, or human disturbed, soil with elevated Ra226.

Regulatory Levels-EPA and Florida

EPA's cleanup standards that have typically been used for Ra226 at CERCLA sites is an ARAR from 40 CFR 192. It is **5 pCi/g + background, outdoors**, and includes a gamma **indoor** rate of **20 uR/hr + background**. The standard for cleanup then would include both a soil "concentration" component and a "flux" for indoor exposure. {Note: the 5 pCi/g ARAR is approx **4E-4** risk, but **is considered a protective** ARAR under CERCLA and is used by most states and federal agencies such as DOE and DOD}

The **indoor** gamma ARAR [20 uR/hr + bkgd] is also in FL DOH regulations, but their standard is in a more stringent form than EPA's. **Their standard is 20 uR/hr, total, including** background. EPA's is 20mR/hr in addition to background, or 20 + 6 [bkgd] = 26 uR/hr.

FL DOH has discussed using a cleanup value for **outdoor** that is equivalent to **500 mrem/year** based on guidance from the National Council on Radiation Protection. This would equate to a 1 in 100 cancer risk.

100 mrem/yr is the recommended dose limit to the general public from *all* radiation sources from international and national guidance, and in some federal agency regulations.

Table of ARARs & Annual vs Hourly Radiation Doses vs Exposure Scenarios

radiation criteria	annual radiation dose rate	hourly dose rate for residential scenario	hrly dose rate for ind/commercial scenario
FL's guidance	500 mrem/yr	80 microrem/hr [uR/hr]	250 uR/hr
NCRP, ATSDR guidance	100 mrem/yr	16 uR/hr	50 uR/hr
bkgd levels in FL	outdoor FL bkgd ~35mrem/yr	6 uR/hr [above #s include this]	same
5 pCi/g ARAR	~ 35 mrem/yr	~ 12 uR/hr	NA
indoor gamma level	~ 120 mrem/yr	20 uR/hr + 6 = 26 uR/hr	NA
